

THE UNO AVIATION MONOGRAPH SERIES

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Nebraska Initiative for Aerospace Research and Industrial Development (NIARID): Final Report

Brent D. Bowen
et al.

August 2002

UNO
Aviation Institute
University of Nebraska at Omaha
Omaha, NE 68182-0508

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- 01-6 thru 01-8 The Conference Proceedings of the 2001 Air Transport Research Society (ATRS) of the WCTR Society
- 01-5 Collegiate Aviation Research and Education Solutions to Critical Safety Issues
- 01-4 A Self Re-Configurable Robotic Infrastructure to Support Space Colonization
- 01-3 Aviation Institute 2001 Self Study Report for the Council on Aviation Accreditation
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This series is co-sponsored by the NASA Nebraska Space Grant Consortium

Principal Investigator

Dr. Brent Bowen is the University of Nebraska Foundation Distinguished Professor in Aviation and serves as Director of the Aviation Institute, University of Nebraska at Omaha (UNO). Effective July 1, 2000, Bowen will become Director of Aviation and Transportation Policy and Research for UNO. He has been appointed as a Graduate Faculty Fellow of the University of Nebraska System-wide Graduate College. Bowen attained his Doctorate in Higher Education and Aviation from Oklahoma State University and a Master of Business Administration degree from Oklahoma City University. His Federal Aviation Administration certifications include Airline Transport Pilot, Certified Flight Instructor, Advanced-Instrument Ground Instructor, Aviation Safety Counselor and Aerospace Education Counselor. Dr. Bowen's research on the development of the national Airline Quality Rating is regularly featured on *ABC's Good Morning America*, *The Cable News Network*, *USA Today*, *The Today Show*, *The Associated Press*, the network evening news shows, and in numerous other national and international media, as well as refereed academic publications. Dr. Bowen has in excess of 250 publications, papers, and program appearances to his credit. His research interests focus on aviation applications of public productivity enhancement and marketing in the areas of service quality evaluation, forecasting, and student recruitment in collegiate aviation programs. He is also well published in areas related to effective teaching. Dr. Bowen is an active industry consultant, pilot, and former fixed-base operator and air carrier operator. He has been an invited expert witness before the U.S. House of Representatives Committee on Government Operations and has served on multiple occasions as an invited speaker and panelist at the National Academy of Sciences/Transportation Research Board. Dr. Bowen was recently appointed to the National Research Council Steering Group on the Small Aircraft Transportation System.

His professional affiliations include the University Aviation Association (recent Board Member), Council on Aviation Accreditation (Committee Chair), World Aerospace Education Organization (Past-President), International Air Transportation Research Group (Proceedings Editor and Network Committee Leader), Aerospace States Association (Governor's Delegate), Alpha Eta Rho International Aviation Fraternity, and the Nebraska Academy of Sciences. Dr. Bowen has been recognized with awards of achievement and commendation from the American Marketing Association, the American Institute of Aeronautics and Astronautics, the Federal Aviation Administration, Embry-Riddle Aeronautical University, the W. Frank Barton School of Business, the Travel and Transportation Research Association, University Aviation Association, World Aerospace Education Organization and others. Additionally, Dr. Bowen has authored/co-authored numerous successful funding proposals totaling awards exceeding \$12.5 million. He also serves as program director and principal investigator for the National Aeronautics and Space Administration funded Nebraska Space Grant Consortium and NASA EPSCoR Program.

Dr. Bowen's research has been published in the *Journal of Aviation/Aerospace Education and Research*, the *Collegiate Aviation Review*, *Journal of Air Transportation World Wide*, *Advances in Marketing*, *Business Research Methods*, as well as other journals, proceedings, books, research monographs, and popular press.

THE NEBRASKA INITIATIVE FOR AEROSPACE RESEARCH AND INDUSTRIAL DEVELOPMENT FINAL REPORT: 1997-2001

The Nebraska Initiative for Aerospace Research and Industrial Development (NIARID) was designed to accelerate the state's efforts to expand its capacity, national competitiveness, and infrastructure in aerospace research and industry. The systemic goal of the NIARID was to strengthen Nebraska's long-term ability to develop new, and strengthen current, aerospace research activities that increase the state's national research competitiveness, foster sustainable growth in aerospace-related industry and the state's economic development; complement the mission and activities of the Nebraska Space Grant Consortium (NSGC); and advance the goals of NASA and its enterprises. Funding from NIARID accelerated the establishment of a permanent national-level research and education center in aerospace science in Nebraska.

The NIARID was founded on, and drew from, a number of supportive structures already in place in the state, including the NSGC, Nebraska EPSCoR, the Nebraska Research Initiative, the Aviation Institute, and the Department of Economic Development.

The NIARID was a program of focused research and infrastructure strengthening, junior faculty development, educational outreach, industrial development, and long-term strategic planning. It took active measures to broaden the spectrum of aerospace research and industry in the state by encouraging the development of innovative scientific investigations. Its structure ensured effective technology transfer by actively involving industry in all facets of its implementation. It was designed to ensure that Nebraska's aerospace research and development continues to thrive long after NIARID funding ends.

Two competitively-selected research clusters, Remote Sensing and Earth Data Systems (RSEDS) and Space Environmental Protection (SEP), formed the initial core of NIARID. The magnitude and impact of these research activities was such that there was successful spin-off research by junior faculty from throughout the state. Both clusters had considerable applications to industry and the state's overall economic development. Both were led by nationally recognized scholars with extensive and successful collaborative experience with NASA. Additionally, substantial competitive seed funds were provided draw in additional faculty and student participants.

In subsequent years of NIARID funding, three additional research clusters were selected. They were: Unmasking Temperature Data: A Reliable Tool for Studies of Circadian Rhythmicity in Astronauts and Airline Pilots (UTD), the Small Aircraft Transportation System (SATS), Transient Numerical Modeling of the Combustion of a Moving Isolated Fuel Droplet with Detailed Chemical Kinetics (IFD), and Airborne Remote Sensing (ARS). Detailed reports for each research cluster are included in this report.

Elevation of Nebraska's junior faculty to a nationally competitive level was accomplished through several measures, including participation in the research clusters, NIARID-funded summer faculty fellowships at NASA research centers, travel grants for academic conferences and collaborative research activities at other universities, a proposal-writing skills teleconference, and activities designed to increase networking with successful senior researchers.

Educational outreach mechanisms were utilized to motivate talented Nebraskan youth, and in particular those from underrepresented populations, to pursue post-secondary and graduate-level education and careers in aerospace science and industry, thereby building an infrastructure of human resources. These activities included research fellowships, internships, and assistantships for undergraduate and graduate students, and summer internships for high school students.

The state's research infrastructure was strengthened in several ways, due to NIARID funding. The NIARID purchased materials to support the research clusters, acquired aerospace science library resources, and developed the Landsat Software and Data Archive. In addition, the NIARID established a website which fosters ongoing collaboration and communication between junior and senior faculty, industry, state government, NIARID administration, and NASA; serves as a vital conduit for aerospace information and events; and provides a valuable information and networking resource for Nebraska's elementary and secondary school students, teachers, and administrators. Finally, NIARID's investment in faculty development and student outreach activities helped to build a human resources infrastructure that continues to support Nebraska's aerospace research and industry development.

To solidify its intent to internalize the state's long-term commitment to aerospace research and industry, NIARID incorporated the development and implementation of a tailored strategic action plan. The development of this plan incorporated extensive input from academe, industry, state economic development specialists, and NASA.

All of these activities occurred within a managerial structure that has a proven record of success and goal achievement. Led by Brent Bowen, Director of the Nebraska Space Grant Consortium, a nationally recognized authority on aviation and aerospace science, the NIARID's administrative structure ensured that the program's goals were met through self- and external evaluation, programmatic and financial oversight, and frequent communication with NASA. Dr. Bowen is assisted by the Nebraska EPSCoR Director and the NIARID Advisory Board (now known as the Technical Advisory Committee), whose membership includes representatives from higher education, industry, and state government.

Name of Project: Remote Sensing and Earth Data Systems

Principal Investigator(s): Dr. Steve Reichenbach

Phone: (402) 472-5007

E-mail: reich@cse.unl.edu

- **Name of Other Sponsors matching funds, other related grant funding agencies and amount of match/grants:**

In addition to UNL sources, see the funded projects listed below.

- **Please provide a one-page description of your project's progress for the five-year EPSCoR period (1997-2001):**

The focus of the overall project was on the technology of remote sensing, especially as it applies to monitoring and analyzing the condition and productivity of agricultural vegetation. The sensors used in the work were operated at close-range, at aircraft altitudes, and in orbit. The primary research site was the University of Nebraska Agricultural Research and Development Center (ARDC), located near Mead, Nebraska. The aim of the work for the 2001 growing season was on using remote sensing to quantify vegetation fraction in corn canopies, with emphasis on the visible spectrum. New techniques to estimate vegetation fraction were developed.

- **What evaluation mechanisms were in place for this project? Please describe.**

Project review meetings, departmental review processes, annual EPSCoR reports and meetings.

- **Collaborative efforts took place with the following:**

In Same Department

Name of department/ Type of Collaboration

Teacher Resource Centers

Name of Teacher Resource Center/ Type of Collaboration

Other Departments in Same Institution

Name(s) of department/ Type of Collaboration

Non-Profit Organizations

Name of organization(s)/ Type of Collaboration

Other Institution of Higher Education

Name of institution(s)/ Type of Collaboration

Organization(s) Representing Women, Underrepresented Minorities, or Persons with Disabilities

Name of organization(s)/ Type of Collaboration

Community College

Name of institution(s)/ Type of Collaboration

K-12 Institution

Name of institution(s)/ Type of Collaboration

Industry/Business

Name of company or organization, location, and type of collaboration

- **Collaboration with NASA Installations: (If any of the following are checked, please provide name, department, phone number, and type of collaboration. If no collaboration is yet established, please state.)**

Ames Research Center, CA

Jet Propulsion Lab, CA

Dryden Flight Research Center, CA

Johnson Space Center, TX

Goddard Space Center, MD

Kennedy Space Center, FL

- | | | | |
|-------------------------------------|---|-------------------------------------|--------------------------|
| <input checked="" type="checkbox"/> | Langley Research Center, VA | <input type="checkbox"/> | Wallops |
| <input type="checkbox"/> | John Glenn Research Center, Lewis Field, OH | <input type="checkbox"/> | Stennis Space Center, MS |
| <input type="checkbox"/> | Marshall Space Flight Center, AL | <input checked="" type="checkbox"/> | NASA Headquarters, DC |

- **Collaboration with NASA Enterprises (please describe):**

- Code M. Human Exploration and the Development of Space
- Code Y. Mission to Planet Earth
- Code R. Aeronautics and Space Transportation Technology
- Code S. Space Science

- **Collaborations with:**

- | | | | |
|--------------------------|---|--------------------------|---|
| <input type="checkbox"/> | Other Space Grant Consortium program
Name of Space Grant and program/ Type of
Collaboration | <input type="checkbox"/> | Other Groups or Agencies
Name of agency or program/ Type of
Collaboration |
|--------------------------|---|--------------------------|---|

- | | | | |
|-------------------------------------|---|--------------------------|---|
| <input checked="" type="checkbox"/> | Other Federal Government
Name of agency or program/ Type of
Collaboration | <input type="checkbox"/> | Other EPSCoR Programs
Name of EPSCoR Program/ Type of
Collaboration |
|-------------------------------------|---|--------------------------|---|

- Other State Agencies
Name of agency or program/ Type of
Collaboration

- Other EPSCoR Agencies:

- | | | | |
|-------------------------------------|-----------------------------|--------------------------|---------------------------------|
| <input checked="" type="checkbox"/> | National Science Foundation | <input type="checkbox"/> | National Institute of Health |
| <input type="checkbox"/> | Department of Defense | <input type="checkbox"/> | Environmental Protection Agency |
| <input type="checkbox"/> | Department of Energy | <input type="checkbox"/> | US Department of Agriculture |

- **Please provide the names of the participants involved and indicate gender and ethnic background on the following table.**

- **Names:**

1. Stephen E. Reichenbach
2. Ram Narayanan
3. William Waltman
4. Aaron Brockmeier

5. Luyin Cao
6. Brian Corner
7. Charles Daniel
8. Fang Geng
9. Andrew Hanson
10. Sherri Harms
11. Gautam Jindal
12. Jing Li
13. Dan Kaiser
14. Lavanya Kunduru
15. Paul Mallas
16. Ameet Savang
17. Qiang Song
18. Nathan Workman
19. Yan Xiong
20. Mingming Zhang
21. Wei Zhong

	Male	Male Under-represented (include disabled)	Female	Female Under- represented (include disabled)	Unknown Race/ Gender
Faculty	3	0	0	0	0/0
Post-Doc	1	0	1	0	0
Graduate Student	10	?	4	?	16/2
Undergraduate Student					
Administrator					
Research Assist/Tech.	1	?			1/0
Other					

If other, please specify:

- **Describe any recruitment and/or retention strategies for members of underrepresented groups (women, minorities, or persons w/disabilities) that ensure participation in this project:**
N/A

- **Activities funded by this project:**

- | | |
|--|--|
| <input checked="" type="checkbox"/> Seed money for research | <input type="checkbox"/> Technical writing services |
| <input checked="" type="checkbox"/> Travel to present paper | <input type="checkbox"/> Student Assistant |
| <input checked="" type="checkbox"/> Travel to attend conference/workshop | <input checked="" type="checkbox"/> Computer Services |
| <input checked="" type="checkbox"/> Establish research collaboration | <input checked="" type="checkbox"/> Develop information resources for research opportunities |
| <input type="checkbox"/> Visiting Scholar | <input type="checkbox"/> Other (Specify) |
| <input type="checkbox"/> Hold conference or Workshop | |
| <input checked="" type="checkbox"/> Proposal Preparation | |

- **Publication Citations related to NASA EPSCoR funding. Please indicate Peer-reviewed/Refereed (if applicable), presentation (if applicable), include all of the citation.**

S. Reichenbach, L. Cao, and R. Narayanan. "Information Efficiency in Hyperspectral Imaging Systems." *Journal of Electronic Imaging*, to appear, 2002.

R. Narayanan, M. Desetty, and S. Reichenbach. "Effect of Spatial Resolution on Information Content Characterization in Remote Sensing Imagery Based on Classification Accuracy," *International Journal of Remote Sensing*, to appear, 2002.

S. Reichenbach and J. Li. "Restoration and Reconstruction from Overlapping Images for Multi-Image Fusion." *IEEE Transactions on Geoscience and Remote Sensing*, 39(4):769-780, 2001.

R. Narayanan, T. Sankaravadivelu, and S. Reichenbach. "Dependence of Image Information Content on Gray-Scale Resolution." *Geocarto International*, 15(4):15--27, 2000.

S. Reichenbach, S. Park, and J. Howe. "Restoration and Range Performance in FLIR Imaging Systems." *Journal of Infrared Physics and Technology*, 38(3):177--192, 1997.

S. Reichenbach and F. Geng. "Improved Cubic Convolution for Two-Dimensional Image Reconstruction," *IEEE Medical Imaging Conference*, CDROM:4p, 2001.

S. Reichenbach *et al.* "WWW Plant Guide: Online Agriculture Decision Support," *International Workshop on Geo-Spatial Knowledge Processing for Natural Resource Management*, European Commission Joint Research Centre, 298--302, 2001.

R. Narayanan, S. Ponnappan, and S. Reichenbach. "Effects of Uncorrelated and Correlated Noise on Image Information Content," *International Geoscience and Remote Sensing Symposium*, IEEE, in press, 2001.

S. Harms *et al.* "Data Mining in a Geospatial Decision Support System for Drought Risk Management," *National Conference on Digital Government Research*, Digital Government Research Center, 9--16, 2001.

L. Cao, S. Reichenbach, and R. Narayanan. "Information Theoretic Assessment and Design of Hyperspectral Imaging Systems with Non-Uniform Bandwidth," *Visual Information Processing*, Proc. SPIE 4388:72--78, 2001.

A. Gadem *et al.* "A Decision Support System for Soil Productivity and Erosion in Polk County Nebraska," *ASPRS Annual Conference*, ASPRS, CDROM:11p, 2001.

S. Reichenbach *et al.* "The Planting Date Calculator: A Decision-Support Tool for Agriculture," *ASPRS Annual Conference*, ASPRS, CDROM:9p, 2001.

M. Tooze *et al.* "Geospatial Decision Support for Seed Companies in the Corn Belt," *ASPRS Annual Conference*, ASPRS, CDROM:12p, 2001.

B. Corner, R. Narayanan, and S. Reichenbach, "Noise Reduction in Remote Sensing Imagery Using Perturbation Modeling and Principal Component Analysis," *Applications of Digital Image Processing XXIII*, Proc. SPIE 4115:1--11, 2000.

R. Narayanan, T. Sankaravadivelu, and S. Reichenbach. "Dependence of Image Information Content on Gray-Scale Resolution," *International Geoscience and Remote Sensing Symposium*, pp. 153—155, 2000.

B. Corner, R. Narayanan, and S. Reichenbach. "Principal Component Analysis of Multisensor Remote Sensing Imagery Combining Additive and Multiplicative Noise," *Applications of Digital Image Processing*, Proc. SPIE 3808:183-191, 1999.

R. Narayanan, T. Sankaravadivelu, and S. Reichenbach. "Effect of Gray-Scale Resolution on Information Content of Remote Sensing Imagery," *Applications of Digital Image Processing*, Proc. SPIE 3808:192-201, 1999.

Q. Song, A. Savant, S. Reichenbach, and E. Ledford. "Digital Image Processing for a New Type of Chemical Separation System," *Applications of Digital Image Processing*, Proc. SPIE 3808:2-12, 1999.

R. Narayanan, M. Desetty, and S. Reichenbach. "Information Content Characterization in Remote Sensing Imagery Based on Classification Accuracy," *International Geoscience and Remote Sensing Symposium*, 131-133, 1999.

S. Reichenbach, Y. Xiong, R. Narayanan, and L. Cao. "Information Theoretic Assessment and Design of Hyperspectral Imaging Systems." *Visual Information Processing*, Proc. SPIE 3716, 100-104, 1999.

S. Reichenbach and F. Geng. "Image Reconstruction with Two-Dimensional Piecewise Polynomial Convolution." *International Conference on Acoustics, Speech, and Signal Processing*, 3237-3240, 1999.

Y. Xiong and S. Reichenbach. "Maximum Mutual Information Estimation of a Simplified Hidden MRF for Offline Handwritten Chinese Character Recognition", *Document Recognition and Retrieval*, Proc. SPIE 3651:58-63, 1999.

B. Corner, R. Narayanan, and S. Reichenbach. "Application of Principal Component Analysis to Multisensor Classification." *AIPR Workshop: Advances in Computer-Assisted Recognition*, Proc. SPIE 3584:202-210, 1999.

M. Desetty, R. Narayanan, and S. Reichenbach. "Characterization of Information Content in Remote Sensing Imagery," *International Geoscience and Remote Sensing Symposium*, pp 2029-2031, 1998.

S. Reichenbach, D. Kaiser, A. Hanson, and J. Li. "Restoration and Reconstruction from Overlapping Images." *Image Registration Workshop*, NASA, 49-55, 1997.

B.~Kess and S.~Reichenbach. Capturing Global Redundancy to Improve Compression of Large Images." *IEEE Data Compression Conference*, 62--71, 1997.

R. Narayanan, M. Desetty, and S. Reichenbach. "Textural Characterization of Imagery in Terms of Information Content," *Ground Target Modeling and Validation Conference*, 69-74, 1997.

- **Patents, Patent Applications, or Invention Disclosures related to NASA EPSCoR funding. Please include all of citation.**

N/A

- **Grants & Financial Awards. Please include the following information in citation(s).**
Digital Government: A Decision Support System for Drought Risk Management. Stephen E. Reichenbach PI, with numerous co-investigators. National Science Foundation (\$1,007,914), August 1, 2001 -- July 31, 2004.

Geospatial Data Integration for Decision Support. Stephen E. Reichenbach PI, with numerous co-investigators. Nebraska Research Initiative (\$994,590), July 1, 1998 -- June 30, 2002.
- **How is this project contributing to the economic development of the state?**
Understanding of agricultural systems is important to the agricultural economy of Nebraska.
- **Describe senior faculty mentoring junior faculty in this project?**
N/A
- **Which non-Ph.D. granting institutions are involved in this project?**
University of Nebraska - Omaha

Name of Project: Space Environmental Protection

Principal Investigator(s): Dr. Ned Ianno

Phone: (402) 472-1965

E-mail: nianno@unl.edu

- **Name of Other Sponsors matching funds, other related grant funding agencies and amount of match/grants:**

University of Nebraska-Lincoln and Nebraska Research Initiative, College of Engineering and Technology, UNL - \$500,000

- **Please provide a one-page description of your project's progress for the five-year EPSCoR period (1997-2001):**

The objective of this work is to deposit and characterize coatings containing primarily the VO₂ phase. This phase has a thermochromic semiconductor to metal transition at 68 °C. The VO₂ thus becomes more reflective and conductive above the transition temperature. One application uses the change in infrared optical properties for thermal switches near room temperature. Precise stoichiometry is required to deposit VO₂ coatings because of competition from other oxide phases. To achieve this stoichiometric control we deposited VO₂ by controlling a plasma emission ratio of vanadium and oxygen. The emission ratio was processed in real time for feedback control. The feedback involved increasing or decreasing the oxygen flow to maintain a desired ratio. Direct current reactive magnetron sputtering was used with a constant current power supply. We varied the deposition temperature between 350 and 650 °C and the amount of oxygen injected into the system from 3.0 – 3.8 sccm. X-ray, resistance, and reflectance measurements verified that the majority phase of the coatings was VO₂. The resistance results showed a change of about three orders of magnitude due to the semiconductor to metal transition. The reflectance results showed emittance changes in the infrared between 61.2 – 90 %, so this is an excellent material for a thermal switch. Space simulation exposures showed that these films could withstand between 3.7 - 37.2 years in space without forming other phases but that their emittance would degrade during this time.

Aluminum nitride (AlN) and aluminum oxynitride (AlNO) films were sputter deposited onto epoxy coated silicon substrates. The films were characterized by electron microscopy, atomic force microscopy, θ -2 θ x-ray diffractometry, and profilometry. The surface morphology of the films was a function of the feed gas oxygen content. Amorphous aluminum oxynitride films formed with oxygen flows of more than 0.5 sccm yielded smooth, continuous coatings over the epoxy. The oxynitride/epoxy/silicon structure was exposed in an electron cyclotron resonance low Earth orbit simulator, and showed 2-3 nm roughening up to the maximum fluence of 2.4×10^{22} atoms/cm². This is equivalent to 94 to 940 days in low Earth orbit, depending on orbit height.

- **What evaluation mechanisms were in place for this project? Please describe.**

Periodic (monthly) meetings with all investigators. Each investigator meets periodically with their students.

- **Collaborative efforts took place with the following:**

In Same Department

Name of department/ Type of Collaboration
Department of Electrical Engineering/ Joint
research-supervising students

Other Departments in Same Institution

Name(s) of department/ Type of Collaboration

Other Institution of Higher Education
Name of institution(s)/ Type of Collaboration
UNO Chemistry Dept./ Exchange of samples for analysis

Community College
Name of institution(s)/ Type of Collaboration

K-12 Institution
Name of institution(s)/ Type of Collaboration

Teacher Resource Centers
Name of Teacher Resource Center/ Type of Collaboration

• **Collaboration with NASA Installations: (If any of the following are checked, please provide name, department, phone number, and type of collaboration. If no collaboration is yet established, please state.)**

Ames Research Center, CA

Dryden Flight Research Center, CA

Goddard Space Center, MD

Jet Propulsion Lab, CA

Johnson Space Center, TX

Kennedy Space Center, FL

Langley Research Center, VA

Non-Profit Organizations
Name of organization(s)/ Type of Collaboration

Organization(s) Representing Women,
Underrepresented Minorities, or Persons with
Disabilities
Name of organization(s)/ Type of Collaboration

Industry/Business
Name of company or organization, location, and
type of collaboration

J.A. Woollam Co.
645 M Street STE 102
Lincoln, NE 68508
Joint analysis of experimental data.

John Glenn Research Center at Lewis Field, OH
Dr. Steven Pepper

NASA Lewis Research Center

21000 Brookpark Rd

MS 23-2

Cleveland, OH 44135

Samples exchanged for analysis.

Marshall Space Flight Center, AL

Wallops

Stennis Space Center, MS

NASA Headquarters, DC

• **Collaboration with NASA Enterprises (please describe):**

Code M. Human Exploration and the Development of Space

Code Y. Mission to Planet Earth

Code R. Aeronautics and Space Transportation Technology

Code S. Space Science

• **Collaborations with:**

Other Space Grant Consortium program
Name of Space Grant and program/
Type of Collaboration

- Other Federal Government
Name of agency or program/ Type of Collaboration
- Other State Agencies
Name of agency or program/ Type of Collaboration
- Other EPSCoR Agencies:
- National Science Foundation
- Department of Defense
- Department of Energy
- Other Groups or Agencies
Name of agency or program/ Type of Collaboration
- Other EPSCoR Programs
Name of EPSCoR Program/ Type of Collaboration
- National Institute of Health
- Environmental Protection Agency
- US Department of Agriculture

• Please provide the names of the participants involved and indicate gender and ethnic background on the following table.

- Names:

Faculty-N.J. Ianno, John A. Woollam, P G.. Snyder, R.O. Dillon, and J. Hagen
 Graduate Students- Kho Lei, Yan Li, H. Enshashy, Y. Bulur, T. Tiwald, C. Bungay, Y. Mo
 Undergraduate Student- Matt Calliccoat
 Research Tech. - Dan Thompson

	Male	Male Under-represented (include disabled)	Female	Female Under-represented (include disabled)	Unknown Race/ Gender
Faculty	5	0	0	0	0
Post-Doc					
Graduate Student	7	0	1	0	0
Undergraduate Student	1				
Administrator					
Research Assist/Tech.	1				

Other					
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If other, please specify:

- Describe any recruitment and/or retention strategies for members of underrepresented groups (women, minorities, or persons w/disabilities) that ensure participation in this project:
- Activities funded by this project:

<input checked="" type="checkbox"/> Seed money for research	<input type="checkbox"/> Technical writing services
<input checked="" type="checkbox"/> Travel to present paper	<input checked="" type="checkbox"/> Student Assistant
<input type="checkbox"/> Travel to attend conference/workshop	<input type="checkbox"/> Computer Services
<input checked="" type="checkbox"/> Establish research collaboration	<input type="checkbox"/> Develop information resources for research opportunities
<input type="checkbox"/> Visiting Scholar	<input type="checkbox"/> Other (Specify)
<input type="checkbox"/> Hold conference or Workshop	
<input type="checkbox"/> Proposal Preparation	
- Publication Citations related to NASA EPSCoR funding. Please indicate Peer-reviewed/Refereed (if applicable), presentation (if applicable), include all of the citation.

Refereed Publications:

Yeon-Gon Mo, R.O. Dillon, and P.G. Snyder, "Synthesis and Spectroscopic Analysis of Infrared Photochromic Materials", in Materials for Smart Systems 2. V. 459, p. 93, published by the Materials Research Society, 1997.

Y.-G. Mo, R.O. Dillon, P.G. Snyder, "Spectroscopic analysis of photochromic films," J. Vac. Sci. Technol. A17, 170-175 (1999)

Y.-G. Mo, R.O. Dillon, P.G. Snyder, "Visible and infrared photochromic properties of amorphous WO₃-x films," J. Vac. Sci. Technol. A17, 2933-2938 (1999)

Y.-G. Mo, R.O. Dillon, P.G. Snyder, T.E. Tiwald, "Optical properties of photochromic organic-inorganic composites," Thin Solid Films 355-356, 1-5 (1999)

N.J. Ianno and T. Mackovicka, "Measurement of the Permeability of Thin Films", Review of Scientific instruments, 70, 2072-2073 (1999).

C. L. Bungay, T.E. Tiwald, M.J. DeVries, B.J. Dworak and J.A. Woollam, "Characterization of UV Irradiated Space Application Polymers by Spectroscopic Ellipsometry", Polymer Engineering & Science 40 (2), 300 (2000).

R.O. Dillon, K. Le, and N.J. Ianno, "Thermochromic VO₂ Sputtered by Control of a Vanadium-Oxygen Emission Ratio", *Thin Solid Films*, 398-399, 10 (2001).

R.O. Dillon, A. Ali, N.J. Ianno, A. Ahmad, and T. Furtaj, "Sound Velocity and Young's Modulus in Plasma Deposited Hydrogenated Carbon", *J. Vac. Sci. Technol. A*, 19, 2826 (2001).

N.J. Ianno, H. Enshashy, and R.O. Dillon, "Aluminum Oxynitride Coatings for Oxidation Resistance of Epoxy Films", *Accepted Surface Coatings and Technology*.

L. Yan, X. Gao, C. Bungay and J.A. Woollam, "Study of Surface Chemical Changes and Erosion Rates for CV-1144-O Silicone under ECR Oxygen Plasma Exposure", *J. Vac. Sci. Technol. A* 19 (2) 447-454 (2001).

Franke, E.; Schubert, M.; Trimble, C.L.; DeVries, M.J.; Woollam, J.A., "Optical properties of amorphous and polycrystalline tantalum oxide thin films measured by spectroscopic ellipsometry from 0.03 to 8.5 eV", *Thin Solid Films*, 388, 283 (2001).

Franke, E.; Trimble, C.L.; DeVries, M.J.; Woollam, J.A.; Schubert, M.; Frost, F., "Dielectric function of amorphous tantalum oxide from the far infrared to the deep ultraviolet spectral region measured by spectroscopic ellipsometry", *J. Appl. Phys.*, 88, 5166 (2000).

Franke, E.B.; Trimble, C.L.; Hale, J.S.; Schubert, M.; Woollam, J.A., "Infrared switching electrochromic devices based on tungsten oxide", *J. Appl. Phys.*, 88, 5777 (2000).

Franke, E.B.; Trimble, C.L.; Hale, J.S.; Schubert, M.; Woollam, J.A., "All-solid-state electrochromic reflectance device for emittance modulation in the far-infrared spectral region", *Appl. Phys. Lett.*, 77, 930 (2000).

Presentations:

R.O. Dillon and Yeon-Gon Mo, "Synthesis and Spectroscopic Analysis of Infrared Photochromic Materials", 1996 Fall Meeting of The Materials Research Society, Boston.

T.E. Tiwald, D.W. Thompson, J.A. Woollam, and S. Pepper, "Determination of the mid-Infrared Optical Constants of Lubricants and Water using an Attenuated Total Reflection Cell combined with Infrared Ellipsometry" International Conf. Of Spectroscopic Ellipsometry-2 Charleston South Carolina, May 12-16, 1997.

C.L. Bungay, T.E. Tiwald, D.W. Thompson, M.J. DeVries, J.A. Woollam, J.F. Elman, "Infrared Ellipsometry Studies of Polymers and Oxygen Plasma Treated Polymers" International Conf. Of Spectroscopic Ellipsometry-2 Charleston South Carolina, May 12-16, 1997.

N.J. Ianno, R.O. Dillon, and Y. Bulur, "Evidence of Field Emission from Reactively Sputtered Doped Amorphous Carbon Films" American Vacuum Society Meeting, Oct. 1997.

Yeon-Gon Mo and R.O. Dillon, "Infrared Photochromism of Tungsten Oxide Films", 1997 Fall Meeting of the Materials Research Society.

Yeon-Gon Mo, R.O. Dillon, and P.G. Snyder, "Synthesis and Spectroscopic Analysis of Infrared Phototchromic Materials", in Materials for Smart Systems 2. V. 459, p. 93, published by the Materials Research Society, 1997.

N.J. Ianno, R.O. Dillon, and Y. Bulur, "Evidence of Field Emission from Reactively Sputtered Aluminum Nitride Thin Films" American Vacuum Society Meeting, Oct. 1997.

L. Yan, J.A. Woollam, "Ellipsometric Studies of Oxygen Plasma Affects on Zinc Selenide" ICMCTF2001, San Diego, April 2001

C. Bungay, D.A. Jaworske, K.K. de Groh and J.A. Woollam, "Evaluation of Optical Degradation of Aluminized Sapphire Flown on the Russian Mir Space Station", ICMCTF2001, San Diego, April 2001.

R.O. Dillon, K. Le and N. Ianno, "Thermochromic VO₂ by control of vanadium-oxygen emission ratio" ICMCTF2001, San Diego, April 2000.

- **Patents, Patent Applications, or Invention Disclosures related to NASA EPSCoR funding. Please include all of citation.**

None

- **Grants & Financial Awards. Please include the following information in citation(s).**

NASA Glenn Research Center

"Atomic Oxygen, Ultraviolet, and Thermal Cycling Effects of Space

Materials". Study the effects of the space environment on materials for use in low earth orbit

\$50,000/yr from 11/98 through 11/2002

J.A. Woollam, UNL

Boeing Space Systems

"Optical Characterization of Thin Metal Films"

\$500,000

8/01-8/02

N.J. Ianno, UNL

- **How is this project contributing to the economic development of the state?**

We have interacted with the J.A. Woollam Co, Lincoln, NE, where we have helped develop products, and several of our graduates are now employed by the Compnay. Also, the Boeing Space Systems program is a joint Woollam Co. UNL effort.

- **Describe senior faculty mentoring junior faculty in this project?**

Interactions occur during meetings, and joint publications are written where all faculty involved in the research contribute to the finished product. In this manner junior faculty benefit from the experience of senior faculty in conducting and disseminating research.

- **Which non-Ph.D. granting institutions are involved in this project?**

UNO

Name of Project: Unmasking Temperature Data: A Reliable Tool for Studies of Circadian Rhythmicity in Astronauts and Airline Pilots

Principal Investigator(s): Dr. Lynne Farr

Phone: (402) 559-6634

E-mail: lafarr@unmc.edu

- **Name of Other Sponsors matching funds, other related grant funding agencies and amount of match/grants:**

This match is in the form of a % of time that is contributed to this project. The dollar amount is calculated from the salary equivalent of that time.

1. Lynne Farr, PI, commitment to project - .20, \$16,921 sal + \$4,230 ben (25%) = \$21,151
2. E. Terence Foster, Co-I, commitment to project - .20, \$12,200 sal + \$2,806 ben (23%) = \$15,006
3. Additional commitment from other funded grants related to EPSCoR project - Nebraska Cancer and Smoking Disease Research Program
Lynne Farr, PI, commitment to project -.20, , \$16,921 sal + \$4,230 ben (25%) = \$21,151

Support from other than time commitment

- 1998 Research enhancement support - Department of Pharmacology, College of Medicine, UNMC. Funds to develop and measure melatonin rhythms by RIA. \$5,000.
- 1999 Statistical Support - Sangeeta Agrawal, BA. MSN, Biostatistician, College of Nursing, UNMC
- 1999 Corporate research support. - The Mini-Mitter Co., Sunriver, Oregon. Equipment loan. \$18,000

- **Please provide a one-page description of your project's progress for the five-year EPSCoR period (1997-2001):**

During this year, feasibility studies were conducted to determine if temperature could be measured simultaneously with activity in healthy active individuals pursuing their daily lives. Twenty subjects were measured, and good comparison data were obtained. Significant relationships were found between their axillary and rectal activity rhythms. However, other rhythmic components were identified as well as residual error that could not be explained by the circadian temperature cycle alone.

Data Analysis and statistical modeling were continued, based on the work from the second year. The three parallel data sets (axillary temperature, rectal temperature, and activity) were examined using a statistical procedure based on the superposition model. This model predicts that the recorded temperature is the sum of endogenous and exogenous components. Under this model, the temperature data can be filtered by complex demodulation so that the circadian endogenous variations in temperature can be separated from the activity dependent exogenous variations in temperature over time.

The secondary analysis of the data sets has proved successful. We are using this method at the present time. This method is also being used in several other studies that have generated grant proposals.

During the EPSCoR funding period, feasibility studies were conducted in order to determine if temperature could be measured simultaneously with activity in healthy active individuals pursuing their daily lives. Twenty two subjects were measured and good comparison data were obtained. Significant relationships were found between their axillary and rectal activity rhythms, however other rhythmic components were identified as well as residual error that could not be explained by the circadian temperature cycle alone. In order to quantify the effects of activity on axillary and rectal temperature and to "unmask" the temperature data, axillary and rectal temperatures as well as wrist actigraph data were measured simultaneously in an additional 30 healthy volunteers for five days. Subjects maintained their typical activity patterns and sleep/wake cycles. They wore the temperature and activity monitors continuously and kept logs of their meals and daily activities. After this initial data was obtained, the process of developing a method of demasking the temperature data was begun.

Data Analysis and statistical modeling were begun on the data. The three parallel data sets (axillary temperature, rectal temperature, and activity) were examined using a statistical procedure based on the superposition model. This model predicts that the recorded temperature is the sum of endogenous and exogenous components. Under this model, the temperature data can be filtered by complex demodulation so that the circadian endogenous variations in temperature can be separated from the activity dependent exogenous variations in temperature over time. This residual exogenous temperature-time data were then studied by statistical methods appropriate to circadian rhythms such as spectral and cosinor analysis. Raw data sets of axillary and rectal temperatures were both strongly rhythmic and circadian (period of 24 hours) for all subjects. Comparison of demodulated temperature data sets from individual subjects demonstrated that activity had a stronger effect on axillary than on rectal temperatures. Axillary and rectal temperatures were closely related in all but one subject in whom the rhythms were inverted. Phase-differences in timing were observed between the rectal and axillary rhythms. Results of this study indicate that the effects of activity can be removed from temperature measurements.

A secondary analysis of the two previous data sets was then conducted. It was thought that using complex demodulation alone removed too much of the temperature that matched the activity rhythm from the analysis. A second analysis plan is being implemented that was suggested from the results of the first analysis. In this method, activity data has been examined to determine the equation which best describes the longitudinal data set. Then this equation is modified using the exercise effect co-factors suggested by Minors & Waterhouse. The resulting equation is then applied to the temperature data from axillary or rectal measurements and adjust the temperature measurements to remove the activity effects. The resulting data set is analyzed for rhythmic parameters.

In the next phase of activity, we began to apply the demasked temperature measurement in studies comparing the circadian activity/rest, sleep/wake rhythms, and melatonin rhythm. Our next group of subjects measured their axillary temperature and wrist activity using the same methods. In addition, they collected saliva samples for analysis of the sleep hormone melatonin in order to determine how the coupling of temperature and melatonin is affected by crossing time zones. Individual studies in which these methods are being used include the following:

Title: Effects of shift work on Native American nurses. Barbara Hobbs, RN MSN, School of Nursing, South Dakota State University, Lynne Farr.

The purpose of this proposal is to compare circadian activity and rest patterns, shiftwork-related sleep disturbances sleepiness during work, circadian melatonin rhythms, and social time custom's effects in American Indian/Alaskan Native Registered Nurses (RN) while working rotating shifts. Specific aims of this proposal are: (1) To determine if Native Americans working flexible shifts experience greater activity/rest disturbances than White non-Hispanic nurses (2) To determine if Native Americans working flexible shifts experience greater sleep disturbance than White non-Hispanic nurses. (3) To determine if Native Americans working flexible shifts experience more sleepiness during work than White non-Hispanic nurses while working rotating shifts (4) To determine if Native Americans working flexible shifts experience greater social time custom disruption than White, non-Hispanic nurses while working rotating shifts

Title: Loss of sleep and fatigue following orthopedic surgery in patients and their caregivers. Lynne Farr, Claudia Chaperon, John Grandgenet, Shannon Yannone & Francine Nelson

The purpose of this study was to measure the sleep/wake patterns of orthopedic surgery patients and their caregivers. 25 patient subjects (PT) and their caregivers (CG) were measured for two days before the PT subject underwent knee joint replacement. PT subjects wore wrist Actilume instruments continually except during bathing during each measurement day. In addition, they collected saliva samples every four hours while they were awake for melatonin determination and when they awakened spontaneously at night.

Wrist activity and ambient light exposure were recorded every 60 seconds. CG subjects wore wrist Actigraphs.

Title: Sleep-related changes in fatigue during peripheral stem cell transplant patients. Lynne Farr, Ph.D, Barbara Manz-Friesth, Ph.D, RN & Ann Berger, Ph.D, RN, Natalie Rasmussen, Majeda El-Banna, Danis Mahar, Lennie Davis.

The purpose of this study is to measure the loss of sleep which accompanies bone marrow transplantation (BMT). Following bone marrow transplantation (BMT) loss of sleep is moderate to severe for months to years following the procedure and may grow worse with time. Fatigue is also a common complaint that may hinder BMT recipients for years. Fatigue also accompanies loss of sleep. The purpose of this study was to compare the circadian sleep/wake, temperature and melatonin rhythms of BMT patients before and after transplantation. Fatigue, sleepiness, temperature, and melatonin secretion were measured and compared with sleep quality. According to staff, patients appear to be sleeping longer following BMT. However, activity recordings indicate that patients are not sleeping much of the time that they may appear quiet. Their sleep is episodic and restless. Patient fatigue increases through their treatment and for the first week after BMT, peaking 6 days post-procedure. Analysis is ongoing on other variables that influence sleep and fatigue such as depression, mucositis, and nausea being examined. It is anticipated that additional factors that contribute to the sleep disruption and fatigue of these patients will be identified.

- **What evaluation mechanisms were in place for this project? Please describe.**

The projects, upon which graduate students worked, were overseen by supervisory committees made up of faculty from the College of Nursing, Medicine, at UNMC, UNO, University of North Carolina – Chapel Hill, and Georgetown University. Publications from these projects have been submitted to peer-reviewed journals and accepted for publication. Presentations from these studies were reviewed by peers at professional organizations.

- **Collaborative efforts took place with the following:**

[x] **In Same Department**

Name of department/ Type of Collaboration

Adult Health & Illness Department, UNMC College of Nursing. Collaboration with Barbara Manz Friesth, DNS, RN., Assistant Professor Dr. Friesth and I are collaborating in clinical research and have submitted three grants together based on methods developed during the EPSCoR Grant.

Adult Health & Illness Department, UNMC College of Nursing. Collaboration with Ann Berger, Ph.D, RN., Assistant Professor Dr. Berger and I are collaborating in clinical research and have submitted three grants together based on methods developed during the EPSCoR Grant.

Adult Health & Illness Department, UNMC College of Nursing. Collaboration with Peggy Tidikis-Menck, Ph.D, RN, Assistant Professor Dr. Tidikis-Menck and I are collaborating in shift-work research and have submitted one grant together based on methods developed during the EPSCoR Grant.

Adult Health & Illness Department, UNMC College of Nursing. Collaboration with Natalie Rasmussen, Ph.D, RN, Assistant Professor. Dr. Rasmussen and I are collaborating in clinical research. She was a member of our research team in the DHHS study of sleep in lymphoma patients. We are preparing a grant submission together based on methods developed during the EPSCoR Grant.

College of Nursing, Collaboration with Sangeeta Agrawal, BA MA. Bio-statistician, Neifeldt Nursing Research Center, Ms Agrawal is a bio-statistician and provides statistical consultation to the project.

[x] **Other Departments in Same Institution**
Name(s) of department/ Type of Collaboration

Department of Pharmacology, UNMC College of Medicine. Collaboration Manuchair Ebadi, Ph.D., Professor. Dr. Ebadi and I have worked together in analyzing melatonin from saliva. We have published our results together in conjunction with

Dr. Francine Nelson who is currently a faculty member at the University of Texas – Houston Medical Branch.

Department of Preventive & Societal Medicine, UNMC College of Medicine. Collaboration with Julie Stoner, Ph.D., Assistant Professor. Dr. Stoner and I are working on completing the statistical methods needed for analysis of the EPSCoR data. Oncology/Hematology, College of Medicine, UNMC. R. Gregory Bociek, MD, Assistant Professor, Dr. Bociek and I are collaborating on the DHHS supported lymphoma study that is using methods developed from the EPSCoR grant.

Other Institution of Higher Education
Name of institution(s)/ Type of Collaboration
College of Engineering, University of Nebraska at Omaha, E. T. Foster, Ph.D, Professor, College of Engineering and Technology, University of Nebraska-Lincoln, University of Nebraska at Omaha.

School of Nursing, South Dakota State University, Collaboration with Barbara Hobbs, MSN, RN, Assistant Professor. Ms. Hobbs and I are collaborating in a shift-work study that is an ongoing part of the EPSCoR project.

Community College
Name of institution(s)/ Type of Collaboration

Organization(s) Representing Women, Underrepresented Minorities, or Persons with Disabilities
Name of organization(s)/ Type of Collaboration
College Nursing Department, Oglala Lakota, a tribally chartered college, Lynne, Margaret Hart, BSN, RN, For some of the life of the EPSCoR grant, we were collaborating in the shift-work study and submitted a grant to NIOSH.

Industry/Business
Name of company or organization, location, and type of collaboration

- **Collaboration with NASA Installations: (If any of the following are checked, please provide name, department, phone number, and type of collaboration. If no collaboration is yet established, please state.)**

Ames Research Center, CA

Langley Research Center, VA

Dryden Flight Research Center, CA

John Glenn Research Center at Lewis Field, OH

Goddard Space Center, MD

Marshall Space Flight Center, AL

Jet Propulsion Lab, CA

Wallops

Johnson Space Center, TX

Stennis Space Center, MS

Kennedy Space Center, FL

NASA Headquarters, DC

Lakshmi Putcha, Ph.D, Senior Pharmacologist, Biomedical Operations and Research Branch, NASA -JSC, Houston, Texas (281) 483-7760 (Voice), (281) 434-4958 (Pager), (281) 244-5734 (Fax)
lputcha@ems.jsc.nasa.gov (E- mail) This collaboration involves the following:

1. Dr. Putcha is a collaborator on the EPSCoR project.
2. I have been analyzing data for Dr. Putcha here at UNMC. The data are from experiments that Dr. Putcha conducted at NASA-JSC.
3. Dr. Putcha trained two of my graduate students in the ELISA assay for salivary melatonin when I sent them to NASA-JSC this Fall.

- **Collaboration with NASA Enterprises (please describe):**

Code M. Human Exploration and the Development of Space

- Code Y. Mission to Planet Earth
- Code R. Aeronautics and Space Transportation Technology
- Code S. Space Science

• **Collaborations with:**

- | | |
|--|--|
| <input type="checkbox"/> Other Space Grant Consortium program
Name of Space Grant and program/
Type of Collaboration | <input type="checkbox"/> Other Groups or Agencies
Name of agency or program/ Type of
Collaboration |
| <input type="checkbox"/> Other Federal Government
Name of agency or program/ Type of
Collaboration | <input type="checkbox"/> Other EPSCoR Programs
Name of EPSCoR Program/ Type of
Collaboration |
| <input type="checkbox"/> Other State Agencies
Name of agency or program/ Type of
Collaboration | |
| <input type="checkbox"/> Other EPSCoR Agencies: | |
| <input type="checkbox"/> National Science Foundation | <input type="checkbox"/> National Institute of Health |
| <input type="checkbox"/> Department of Defense | <input type="checkbox"/> Environmental Protection Agency |
| <input type="checkbox"/> Department of Energy | <input type="checkbox"/> US Department of Agriculture |

• **Please provide the names of the participants involved and indicate gender and ethnic background on the following table.**

This is the list for the entire period.

Names:

1. Barbara Manz-Friesth 2. Ann Berger 3. Terry Foster 4. Claudia Chaperon 5. Barbara Hobbs
6. Peggy Tidikis-Menck 7. Natalie Rasmussen 8. Lennie Davis 9. Sangeeta Agrawal
10. Margaret Hart 11. Danis Mahar 12. Majeda El-Banna 13. Kimberly Wielgus
14. Elizabeth Schreiner 15. John Grandegenet 16. Shannon Yannone
17. Francine Nelson

	Male	Male Under-represented (include disabled)	Female	Female Under-represented (include disabled)	Unknown Race/ Gender

Faculty	1		6	2	
Post-Doc					
Graduate Student	1		9	2	
Undergraduate Student					
Administrator					
Research Assist/Tech.					
Other					

If other, please specify:

- **Describe any recruitment and/or retention strategies for members of underrepresented groups (women, minorities, or persons w/disabilities) that ensure participation in this project:**

Gender distribution of subjects in our project exceeds that of the general population with respect to women. To date, seventy two percent of the subjects have been female. Attempts were made to recruit more men to the study, however, several men who called for information found the study to not be compatible with their work requirements. Efforts have been made to recruit more minority subjects for the study. Fliers advertising the study were placed in locations where members of minority groups were likely to see them. Examples of these locations are the Chicano Awareness Center and churches in neighborhoods that are predominantly minority in makeup. At the present time, the study continues to recruit and measure subjects. In a second study undertaken by a masters student that is also contributing data to the EPSCoR project, fifty subjects are being studied and 25 of these subjects (50%) will be African American. This study is designed to improve health care of African Americans while also contributing temperature data for the EPSCoR project.

In the shift work study being conducted in South Dakota, all of the subjects studied thus have been female Native Americans since this study deals with the effects of shift work on Native Americans, it is a requirement of participation. Subjects were recruited at the national meeting of the American Indian Alaska Native Nurses Society. Eighty two Native American nurses participated completing the survey forms. At the present time, additional Native American nurses are completing an online survey based on the results of this study.

In the study of bone marrow transplant patients, 45% of the subjects have been female. Two of the male subjects were minority.

• **Activities funded by this project:**

- | | |
|---|---|
| <input type="checkbox"/> Seed money for research | <input type="checkbox"/> Technical writing services |
| <input type="checkbox"/> Travel to present paper | <input type="checkbox"/> Student Assistant |
| <input type="checkbox"/> Travel to attend conference/workshop | <input type="checkbox"/> Computer Services |
| <input type="checkbox"/> Establish research collaboration | <input type="checkbox"/> Develop information resources for research opportunities |
| <input type="checkbox"/> Visiting Scholar | <input type="checkbox"/> Other (Specify) |
| <input type="checkbox"/> Hold conference or Workshop | |
| <input type="checkbox"/> Proposal Preparation | |

• **Publication Citations related to NASA EPSCoR funding. Please indicate Peer-reviewed/Refereed (if applicable), presentation (if applicable), include all of the citation.**

Peer-Reviewed publications using data and methods developed with the help of NASA EPSCoR funding.

Nelson, F. Farr, L. & Ebadi, M. (2001) Salivary melatonin response to acute pain stimuli. Pineal Research, 30(4):206-212.

Farr, L., Toderò, C. & Boen, L. (2002) Reducing disruption of circadian temperature rhythms following surgery. Biological Research for Nursing. 2(3):257-266.

Berger, A., VonEssen, S., Kuhn, B., Piper, B., Farr, L., Agrawal, S., Lynch, J. and Higginbotham, P. (2002, accepted) Feasibility of a Sleep Intervention During Adjuvant Breast Cancer Chemotherapy. Oncology Nursing Forum. publication anticipated November/December.

Rasmussen, N. & Farr, L. (2002, submitted) Variation in nociceptive sensitivity and beta-endorphin, Biological Research for Nursing

Olson, E. & Farr, L. (2002, submitted) Effects of sleep disruption following surgery on cardiovascular circadian rhythms. Research for Nursing Practice.

Presentations made at national meeting using data and methods developed with the help of NASA EPSCoR funding.

Chaperon, C. M. & Farr, L. A. (1998) Circadian rhythm and sleep differences between community-dwelling and institutionalized older adults. Annual Meeting, The Geriatrics Society of America

Farr, L. A., Foster, E. T. & Boen, L. M. (1997) How much does activity affect temperature? A comparison of activity with axillary and rectal circadian temperature rhythms. NASA Space Grant Aeronautics Working Group conference, Dryden Air Force Base, Edwards, California.

Farr, L. A., Boen, L. M. & Foster, E. T. (1998), How much does activity affect temperature? A comparison of activity with axillary and rectal circadian temperature rhythms. XXI Annual Meeting, Midwest Nursing Research Society, Columbus, Ohio.

Farr, L. A., Grandgenett, J., Chaperon, C., Nelson, F., Yannone, S. and Bakewell, R. (1999) Sleep disturbance in patients and their care givers following arthroplastic surgery. XXIII Annual Meeting, Midwest Nursing Research Society, Indianapolis, Indiana

Farr, L. A., & Foster, E. T. (2000), De-masking temperature: comparison of activity with axillary and rectal circadian temperature rhythms. I X Annual Meeting, Midwest Nursing Research Society, Dearborn, Michigan (Paper presented, April, 2000)

Farr, L. A., & Foster, E. T. (2000), De-masking temperature: comparison of activity with axillary and rectal circadian temperature rhythms. Biannual Meeting, Society for Research in Biological Rhythms, Amelia Island, Florida (Paper presented, May, 2000)

Rasmussen, N. & Farr, L. (2000), Morphine effects on circadian nociception and beta-endorphin. I X Annual Meeting, Midwest Nursing Research Society, Dearborn, Michigan (Paper presented, April, 2000) Paper awarded Outstanding Doctoral Student Research Presentation for 2000 Meeting. Also awarded Outstanding Pain Research Presentation for 2000 Meeting.

Chaperon, C. & Farr, L. (2000) Circadian rhythm and sleep differences between community-dwelling and institutionalized older adults. Society for Research in Biological Rhythms, (Paper presented, May, 2000).

Farr, L., Chaperon, C., Grandgenett, J., Nelson, F., Yannone, S. (2000) Alteration in melatonin rhythms following surgery. Society for Research in Biological Rhythms, (Paper presented May, 2000)

Rasmussen, N. & Farr, L. (2000) Variation in Nociceptive Sensitivity and Beta-endorphin in Male DBA Mice. Society for Research in Biological Rhythms, (Paper presented, May, 2000)

Presentations made at regional and local meetings using data and methods developed with the help of NASA EPSCoR funding.

Farr, L. A., Foster, E. T., Chaperon, C. & Boen, L. (1999) Complex demodulation of core temperatures: A follow up study. Annual Meeting Nebraska Academy of Sciences, Lincoln, NE

Rasmussen, N. & Farr, L. (2000) Variation in Nociceptive Sensitivity and Beta-endorphin in Male DBA Mice. (presented at the Nebraska Academy of Sciences, April, 2000).

Farr, L., Manz, B. & Berger, A. (2001) Relationship between sleep, pain and fatigue in peripheral stem cell transplant patients. Annual Meeting Nebraska Academy of Sciences, Lincoln, NE

Farr, L, Manz-Friesth, B. & Berger, A. (2002) Sleep-related changes in fatigue during peripheral stem cell transplant patients. Annual Meeting Nebraska Academy of Sciences, Lincoln, NE

- **Patents, Patent Applications, or Invention Disclosures related to NASA EPSCoR funding. Please include all of citation.**
- **Grants & Financial Awards. Please include the following information in citation(s).**

Name of agency or program/ Type of Collaboration

NCI proposal title: Circadian disruption effects on sleep, pain, and fatigue in stem cell transplant patients. L. Farr, PI; B. Manz; A. Berger; & J. Eilers, Co-Is \$320,000 for 3 years. This grant was submitted October 1, 2000. It was not funded on the first round and will be resubmitted in June, 2002.

NIOSH proposal title: Accidents and injury to minority workers during flexible and changing shifts, L. Farr, PI & B. Hobbs, Co-I \$106,000 for 3 years. This grant was submitted October 1, 2000. . It was not funded on the first round and will be resubmitted in June, 2002.

Nebraska Department of Health & Human Services, Loss of sleep and fatigue in stem cell transplantation \$40,000, This grant was funded July, 2000 to June, 2001.

American Cancer Society. Circadian disruption effects on sleep, pain, and fatigue in stem cell transplant patients. L. Farr, PI; B. Manz-Friesth; A. Berger; & J. Eilers, Co-Is \$300,000 for 5 years. This grant was submitted October 15, 2000. It was not funded on the first round and will be resubmitted in July, 2002.

How is this project contributing to the economic development of the state?

These projects will contribute to the economy of the state by providing salary for research associates and research nurses. It has also supported several graduate students in their research and training. Equipment and supplies have been purchased locally. It anticipated that a set of software will be the product of this grant that can be marketed as an addition to several types of research equipment used to monitor human subjects in the field. Methods have been developed and validated that will allow studies of shift workers such as ground aviation ground crews, air traffic controllers, and health-care professionals. Additionally, information will be provided which will benefit Nebraska citizens as part of health care delivery. Sleep and fatigue in cancer patients receiving stem cell transplantation should be improved as well as the sleep of their caregivers.

- **Describe senior faculty mentoring junior faculty in this project?**

Six junior faculty members has been involved in this project. Four are here at UNMC, one at South Dakota State University, and one at Ogalla Community College. They are actively involved in data collection and in analysis of data. Two students received their Ph.Ds with EPCoR support. One graduate student who was awarded her Ph.D, is still involved in the research of this project as a faculty member.

- **Which non-Ph.D. granting institutions are involved in this project?**

SDSU may grant the Ph.D. in some of their departments, but not in their School of Nursing. This is the department that is involved in this project. Also, a junior faculty member at Ogalla Community College has also been involved.

Name of Project: Small Aircraft Transportation System

Principal Investigator(s): Dr. Scott Tarry

Phone: (402) 554-3190

E-mail: starry@unomaha.edu

- **Name of Other Sponsors matching funds, other related grant funding agencies and amount of match/grants:**

University of Nebraska at Omaha

- **Please provide a one-page description of your project's progress for the five-year EPSCoR period (1997-2001):**

Years 4 and 5 saw the further development and refinement of the decision support model initiated by Moussavi. A pilot verbal model developed in Year 4 provided the foundation for the initial development of mathematical/computer models. Moussavi continues to direct the research of his graduate assistant, who is testing sub-models against data from Nebraska's aviation and airport system. The results of these tests will provide a sound basis for the development and testing of additional sub-models and at some point the entire generalized decision-support model. Moussavi continues his close collaboration with the systems engineering staff at LaRC.

As proposed, Nebraska SATS researchers continued to explore SATS implementation from a variety of political, social, and economic perspectives. Work on these substantive areas has been coordinated with the development of the decision support model. This allows the information and findings from policy research to inform the constructs employed in the development of the sub-models. The strength of the research team is found in the diversity of substantive experience and expertise. Dr. Scott Tarry supported NASA Langley SATS researchers through his efforts to identify key public policy issues during a Summer Faculty Research Fellowship in 2000. Tarry studied the impact that SATS could have on rural communities and presented initial findings at the first meeting of the TRB committee assembled to study SATS from the public policy perspective. Nanette Scarpelini-Metz, a PhD student in the Public Administration program examined the institutional changes that occurred during the phase out of the AGATE program and the initiation of the SATS program during her Summer Fellowship in 2001. John Bartle continued his work on public financing of SATS related airport enhancements and continued to mentor Richard Swayze, a PhD student writing his dissertation on airport finance. Russell Smith has coordinated the development of regional cooperation on SATS implementation. He has worked to establish the Nebraska SATS Advisory Committee and to enhance the regional cooperation and collaboration that began with the SATS Symposium held in Rapid City, SD in 2000.

Community outreach and education remained an essential focus for the research team. Graduate students have been engaged in research with faculty mentors. The public, specifically underrepresented groups such as Nebraska's Native American population have benefited from SATS related work through the Family Science program. Faculty researchers have continued to present their work to a variety of academic, industry, and public audiences. This work will necessarily continue, as the SATS concept is refined.

- **What evaluation mechanisms were in place for this project? Please describe.**

Progress is monitored through group and individual meetings. The meetings allow members of the CRT to compare their progress with the expectations and objectives established in the CRT's original proposal. Evaluations are based on the quality and quantity of research outcomes, such as conference papers and published manuscripts.

- **Collaborative efforts took place with the following:**

[XX] In Same Department
Name of department/ Type of Collaboration

CRT Principal Investigator Tarry and CRT member Bowen are members of the University of Nebraska at Omaha's Aviation Institute.

Other Departments in Same Institution
Name(s) of department/ Type of Collaboration
CRT members Smith, Bartle, Reed, and Reed are faculty in the University of Nebraska at Omaha's Department of Public Administration.

Other Institution of Higher Education
Name of institution(s)/ Type of Collaboration
CRT members Massoum Moussavi, and his graduate assistant Jaime Vargas, represent the University of Nebraska at Lincoln's College of Engineering.

Community College
Name of institution(s)/ Type of Collaboration

K-12 Institution
Name of institution(s)/ Type of Collaboration
Shelly Avery represents Nebraska Indian Community College and collaborates with University of Nebraska at Omaha research faculty on the CRT.

Teacher Resource Centers
Name of Teacher Resource Center/ Type of Collaboration

Non-Profit Organizations
Name of organization(s)/ Type of Collaboration

Organization(s) Representing Women, Underrepresented Minorities, or Persons with Disabilities
Name of organization(s)/ Type of Collaboration

Industry/Business
Name of company or organization, location, and type of collaboration

• **Collaboration with NASA Installations: (If any of the following are checked, please provide name, department, phone number, and type of collaboration. If no collaboration is yet established, please state.)**

Ames Research Center, CA

Dryden Flight Research Center, CA

Goddard Space Center, MD

Jet Propulsion Lab, CA

Johnson Space Center, TX

Kennedy Space Center, FL

Langley Research Center, VA
Name: Bruce Holmes
Department: General Aviation Program Office, LaRC
Phone Number: 757-864-3863
Type: collaboration included numerous phone conferences and face-to-face meetings related to SATS implementation and systems assessment

Name: Pete McHugh
Department: FAA, SATS Liaison, LaRC
Phone Number: 747-864-3863
Type: collaboration included numerous phone conferences and face-to-face meetings related to SATS implementation and FAA regulations and policies

Name: Stuart Cooke
Department: Systems Engineering, LaRC
Phone Number: 757-864-3863
Type: collaboration included numerous phone conferences and face-to-face meetings related systems assessment and analysis

John Glenn Research Center at Lewis Field, OH

Marshall Space Flight Center, AL

Wallops

Stennis Space Center, MS

NASA Headquarters, DC

• **Collaboration with NASA Enterprises (please describe):**

Code M. Human Exploration and the Development of Space

Code Y. Mission to Planet Earth

Code R. Aeronautics and Space Transportation Technology

Code S. Space Science

• **Collaborations with:**

Other Space Grant Consortium program (Name of Space Grant and program/ Type of Collaboration)
CRT collaborates with the Nebraska NASA Space Grant Consortium, which provides funding for supporting researchers and staff.

Other State Agencies
Name of agency or program/ Type of Collaboration
CRT collaborates with the Nebraska Department of Aeronautics. Director and Staff Engineer assist CRT with data and other research materials related to the Nebraska Aviation System Plan and aeronautics issues in the state.

Other Federal Government
Name of agency or program/ Type of Collaboration

Other EPSCoR Programs
Name of EPSCoR Program/ Type of Collaboration

Other Groups or Agencies
Name of agency or program/ Type of Collaboration

Other EPSCoR Agencies:

National Science Foundation

National Institute of Health

Department of Defense

Environmental Protection Agency

Department of Energy

US Department of Agriculture

• **Please provide the names of the participants involved and indicate gender and ethnic background on the following table.**

• **Names:**

1. **John Bartle**, Associate Professor, University of Nebraska at Omaha
2. **Brent D. Bowen**, Professor, University of Nebraska at Omaha
3. **Massoum Moussavi**, Associate Professor, University of Nebraska at Omaha
4. **B.J. Reed**, Professor, University of Nebraska at Omaha
5. **Christine Reed**, Professor, University of Nebraska at Omaha
6. **Russell Smith**, Professor, University of Nebraska at Omaha
7. **Scott E. Tarry**, Associate Professor, University of Nebraska at Omaha
8. **Shelley Avery**, Nebraska Indian Community College
9. **Hank Lehrer**, University of Nebraska at Omaha
10. **Jerome Deichert**, Research Associate, University of Nebraska at Omaha
11. **Michaela Schaaf**, Research Associate, University of Nebraska at Omaha
12. **Scott Vlasek**, Information Specialist, University of Nebraska at Omaha
13. **Patrick O'Neil**, Graduate Student, University of Nebraska at Omaha
14. **Todd Bonkiewicz**, Graduate Student, University of Nebraska at Omaha
15. **Nanette Scarpellini-Metz**, Graduate Student, University of Nebraska at Omaha
16. **Jaime Vargas**, Graduate Student, University of Nebraska at Omaha
17. **Basel El-Kasaby**, Graduate Student, University of Nebraska at Omaha
18. **Jinliang Zhu**, Graduate Student, University of Nebraska at Omaha
19. **Karisa Vlasek**, Staff Research Assistant, University of Nebraska at Omaha

	Male	Male Under-represented (include disabled)	Female	Female Under- represented (include disabled)	Unknown Race/ Gender
Faculty	6		2	1	
Post-Doc					
Graduate Student	3	1	1		
Undergraduate Student					
Administrator					
Research Assist/Tech.	2		2		
Other	1				

If other, please specify: retired faculty member

- **Describe any recruitment and/or retention strategies for members of underrepresented groups (women, minorities, or persons w/disabilities) that ensure participation in this project:**

Conscious efforts have been made to ensure the participation of underrepresented groups in the CRT. Women are represented at all levels of the CRT, including staff researcher, graduate assistant, and faculty researcher. Minority groups, Hispanics and Native Americans, are represented as well. Efforts to identify and recruit additional CRT members from underrepresented groups will be a priority in the coming years of the research program

- **Activities funded by this project:**

- | | |
|--|--|
| <input checked="" type="checkbox"/> Seed money for research | <input type="checkbox"/> Technical writing services |
| <input checked="" type="checkbox"/> Travel to present paper | <input checked="" type="checkbox"/> Student Assistant |
| <input checked="" type="checkbox"/> Travel to attend conference/workshop | <input checked="" type="checkbox"/> Computer Services |
| <input checked="" type="checkbox"/> Establish research collaboration | <input checked="" type="checkbox"/> Develop information resources for research opportunities |
| <input type="checkbox"/> Visiting Scholar | <input type="checkbox"/> Other (Specify) |
| <input checked="" type="checkbox"/> Hold conference or Workshop | |
| <input checked="" type="checkbox"/> Proposal Preparation | |

- **Publication Citations related to NASA EPSCoR funding. Please indicate Peer-reviewed/Refereed (if applicable), presentation (if applicable), include all of the citation.**

Bartle, J., Deichert, J., & Hinton, D. W. (1999, September). *Implementing the Small Aircraft Transportation System (SATS) in Nebraska: Public finance and economic issues in planning SATS in the states*. Unpublished manuscript, University of Nebraska at Omaha Aviation Institute.

Bartle, J., Bowen, B. D., & Smith, R. (2000). *Planning SATS implementation in Nebraska*. Paper presented at the National Conference of the American Society for Public Administration, San Diego.

Bartle, J. (1999). *Financing the airport of the future: The Small Aircraft Transportation System*. Paper presented at the National Tax Association Annual Conference, Atlanta.

Bartle, J., Bowen, B. D., Deichert, J., Lehrer, H. R., Krane, D., Reed, B. J., & Smith, R. (1999, August 17). *Policy implications for implementation of SATS at the state and local levels*. Paper presented at the National Academy of Sciences, Washington, DC.

Bowen, B., Holmes, B., et al. (1999). NASA EPSCoR Nebraska Preparation Grant, Year 1 (UNO Aviation Institute Monograph Report 99-2). Omaha, NE: University of Nebraska at Omaha Aviation Institute.

Bowen, B., et al. (1999, March). NASA Nebraska EPSCoR Preparation Grant: Year 1. University of Nebraska at Omaha, Omaha, NE.

Bowen, B. D. (1999 October 19-21). *The Small Aircraft Transportation System for America: A case in public infrastructure change*. Prepared for the World Congress on Aviation, San Francisco, CA.

Bowen, B. & Hansen, F. (October 2000). *Implementing a National Small Aircraft Transportation System: A Public Infrastructure Challenge*. Public Works Management and Policy. Vol. 5, No. 2, pp. 160-169.

Bowen, B. D., Holmes, B., & Hansen, F. (1999, May). *The Small Aircraft Transportation System: Public infrastructure systems research component*. Paper presented at the Aeronautics and Space Sciences Section of Nebraska Academy of Sciences, Lincoln, NE.

Bowen, B., Holmes, B., & Hansen, F. (1999, May). *Development of a 21st century Small Aircraft Transportation System*. Paper presented at the Aeronautics and Space Sciences Section of Nebraska Academy of Sciences, Lincoln, NE.

Carstenson, L. (1999). Legal Implications for SATS. Unpublished grant submission. University of Nebraska at Kearney.

Cullan, T., Hansen, F., & Vlasek, S. (1999, October). *The Small Aircraft Transportation System: A public infrastructure challenge for the next century: Panel discussion for the ASPA conference*. Unpublished manuscript, University of Nebraska at Omaha Aviation Institute.

Lehrer, H., & Penney, K. (1999). SATS Policy Issues. Unpublished manuscript. University of Nebraska at Omaha Aviation Institute.

Lehrer, H., Waugh, T., & Penney, K. (1999, September). *Implementing SATS in Nebraska: Airport change, compliance and rural demographics*. Unpublished manuscript, University of Nebraska at Omaha Aviation Institute.

Paulsen, D., & Reed, B. J. (1991, February). Small towns lack the capacity for successful development efforts. Occasional Paper (No. 91-1). Omaha, NE: Center for Public Affairs Research.

Reed, B. J., Smith, R., & White, J. (1990). Emerging management issues in small communities. *New Directions in Public Administration Research*, 2 (3), 38-40.

Smith, Russell L, and Wachal, J. (1999). *General Aviation in Nebraska: Nebraska SATS Project. Background Paper No. 1.* U.S. Department of Transportation. Federal Aviation Administration. (1992). *Estimating the Regional Significance of Airports.* Washington, DC: Government Printing Office.

Smith, R., & Wachal, J. (1999). *General Aviation in Nebraska: Nebraska SATS Project Background Paper No. 1.* Omaha, NE: University of Nebraska at Omaha.

Smith, R., & Wachal, J. (1999). *General Aviation in Nebraska: Nebraska SATS Project Background Paper No. 1.* Unpublished manuscript, University of Nebraska at Omaha Aviation Institute.

Tarry, S.E. (July 2000). The impact of a Small Aircraft Transportation System on air transport and aviation noise. Presented at the 2000 NOISE Summer Conference and Aviation Noise Symposium, Louisville, Kentucky.

Tarry, S.E. and Bowen, B.D. (July 2000). Optimizing airspace system capacity through a Small Aircraft Transportation System. Paper presented at the Air Transport Research Group Meeting in Amsterdam, The Netherlands.

- **Patents, Patent Applications, or Invention Disclosures related to NASA EPSCoR funding. Please include all of citation.**

No.

- **Grants & Financial Awards. Please include the following information in citation(s).**

- Granting agency or institution
- Title of project
- Purpose of award
- Amount awarded
- Duration of the award
- Principal investigator and co-PIs (initials, last names, institutions)
- Institution
- Date award received
- Date of project implementation
- Indicate proposals not funded

- **How is this project contributing to the economic development of the state?**

The SATS CRT's focus is on the implementation of a transportation system that will enhance economic development opportunities for the people of Nebraska, especially those living in small communities and rural areas where air transportation services are inadequate or nonexistent. Working with the Nebraska Department of Aeronautics and other relevant state officials, the CRT believes its research will have a real and significant impact on the quantity and quality of air transportation services in the state.

- **Describe senior faculty mentoring junior faculty in this project?**

N/A

- **Which non-Ph.D. granting institutions are involved in this project?**

Nebraska Indian Community College

Name of Project: Airborne Remote Sensing
Principal Investigator: Dr. Ram Narayanan
Phone: (402) 472-5141
E-mail: rnarayanan@unl.edu

- **Name of Other Sponsors matching funds, other related grant funding agencies and amount of match/grants:**

University of Nebraska-Lincoln. Match is in the total amount of \$24,000, and in the form of in-kind salary support for faculty, 2 graduate students for 2 summer months, corresponding fringe benefits and tuition waiver, overhead costs, as well as waiver of overhead costs for the grant support.

- **Please provide a one-page description of your project's progress for the five-year EPSCoR period (1997-2001):**

The Aircraft Remote Sensing mini-cluster was a new addition to EPSCoR funding. The Principal Investigator, Dr. Ram Narayanan at the University of Nebraska – Lincoln, had earlier established collaboration with NASA researchers at Goddard, Wallops, and Stennis research facilities. The objectives of the project were the further development of an airborne remote sensing facility targeted at applications, commercialization, and education programs in the area of precision agriculture. This critical area is within the scope of NASA goals and objectives of NASA's Applications, Technology Transfer, Commercialization, and Education Division, and the Earth Science Enterprise. During the project duration of one year, we continued the development of sensor technologies for deployment on the University of Nebraska remote sensing aircraft platform. These sensor technologies included hyperspectral passive sensors, active laser sensors, and active synthetic aperture radar (SAR) sensors. We also investigated accurate aircraft positioning techniques for remote sensing applications. As part of the major objective of this research during Year V funding, we succeeded in establishing airborne remote sensing as an integral part of and a practical tool for site-specific management of agricultural crops. This unique integration of Aerospace (Aeronautics) Technology Enterprise applications with other NASA enterprises thus serves as a model of cross-enterprise transfer of science with specific commercial applications.

The facility has already started paying dividends. In addition to the new NASA EPSCoR funding obtained, we also received support from other agencies and institutions, such as the University of Miami and the U.S. Department of Agriculture. We are currently developing a proposal to the U.S. Department of Energy and plan to collaborate with Brookhaven National Laboratory.

Other accomplishments include the acceptance of papers for presentations at major conferences, such as the Nebraska Academy of Sciences Meeting (7 papers) and the International Geoscience and Remote Sensing Symposium (5 papers). We are hoping to have some peer-reviewed articles submitted soon.

- **What evaluation mechanisms were in place for this project? Please describe.**

We conducted monthly progress review meetings in which faculty and graduate students presented research results and discussed plans for the future. These meetings provided an opportunity for all researchers to learn about what everyone else was doing and to provide constructive comments and suggestions. Thus, we were able to ensure that the entire project and the individual sub-projects were on track.

- **Collaborative efforts took place with the following:**

In Same Department

Name of department/ Type of Collaboration

Other Departments in Same Institution

Name(s) of department/ Type of Collaboration

Other Institution of Higher Education
Name of institution(s)/ Type of Collaboration
University of Nebraska at Omaha/Technical Discussions

Community College
Name of institution(s)/ Type of Collaboration

K-12 Institution
Name of institution(s)/ Type of Collaboration

Teacher Resource Centers
Name of Teacher Resource Center/ Type of Collaboration

Non-Profit Organizations
Name of organization(s)/ Type of Collaboration

Organization(s) Representing Women,
Underrepresented Minorities, or Persons with
Disabilities
Name of organization(s)/ Type of Collaboration

Industry/Business
Name of company or organization, location, and
type of collaboration

• **Collaboration with NASA Installations: (If any of the following are checked, please provide name, department, phone number, and type of collaboration. If no collaboration is yet established, please state.)**

Ames Research Center, CA

Dryden Flight Research Center, CA

Goddard Space Center, MD

Jet Propulsion Lab, CA

Johnson Space Center, TX

Kennedy Space Center, FL

Langley Research Center, VA

John Glenn Research Center at Lewis Field, OH

Marshall Space Flight Center, AL

Wallops

Stennis Space Center, MS

NASA Headquarters, DC

At the NASA Goddard Space Flight Center (GSFC), we collaborated with Dr. James Kalshoven who is the NASA SBIR Program Manager. His telephone number is (301) 286-5806, and his email address is kalshoven@gsfc.nasa.gov

Collaboration was in the form of discussions on refurbishing the NASA developed laser sensor for our use in the research.

• **Collaboration with NASA Enterprises (please describe):**

Code M. Human Exploration and the Development of Space

Code Y. Mission to Planet Earth

Code R. Aeronautics and Space Transportation Technology

Code S. Space Science

• **Collaborations with:**

Other Space Grant Consortium program
Name of Space Grant and program/
Type of Collaboration

Other Federal Government
Name of agency or program/ Type of Collaboration

Other State Agencies
Name of agency or program/ Type of Collaboration

Other Groups or Agencies
Name of agency or program/ Type of Collaboration

Other EPSCoR Programs
Name of EPSCoR Program/ Type of Collaboration

[] Other EPSCoR Agencies:

[] National Science Foundation

[] National Institute of Health

[] Department of Defense

[] Environmental Protection Agency

[] Department of Energy

[] US Department of Agriculture

- Please provide the names of the participants involved and indicate gender and ethnic background on the following table.

- Names:

1. Ram M. Narayanan
2. Brian R. Corner
3. Archana Barke

	Male	Male Under-represented (include disabled)	Female	Female Under-represented (include disabled)	Unknown Race/ Gender
Faculty	1				
Post-Doc					
Graduate Student	1		1		
Undergraduate Student					
Administrator					
Research Assist/Tech.					
Other					

If other, please specify:

- Describe any recruitment and/or retention strategies for members of underrepresented groups (women, minorities, or persons w/disabilities) that ensure participation in this project:

We actively sought underrepresented groups to participate in the project. We posted flyers and announcements on our bulletin boards and our web pages.

- **Activities funded by this project:**

- | | |
|--|---|
| <input type="checkbox"/> Seed money for research | <input type="checkbox"/> Technical writing services |
| <input type="checkbox"/> Travel to present paper | <input type="checkbox"/> Student Assistant |
| <input type="checkbox"/> Travel to attend conference/workshop | <input type="checkbox"/> Computer Services |
| <input checked="" type="checkbox"/> Establish research collaboration | <input type="checkbox"/> Develop information resources for research opportunities |
| <input type="checkbox"/> Visiting Scholar | <input type="checkbox"/> Other (Specify) |
| <input type="checkbox"/> Hold conference or Workshop | |
| <input checked="" type="checkbox"/> Proposal Preparation | |

- **Publication Citations related to NASA EPSCoR funding. Please indicate Peer-reviewed/Refereed (if applicable), presentation (if applicable), include all of the citation.**

None.

- **Patents, Patent Applications, or Invention Disclosures related to NASA EPSCoR funding. Please include all of citation.**

None.

- **Grants & Financial Awards. Please include the following information in citation(s).**

None.

- **How is this project contributing to the economic development of the state?**

The project will develop techniques for economic and timely monitoring of the condition of agricultural crops, such as corn and soybean, which form a large portion of the state's economy.

- **Describe senior faculty mentoring junior faculty in this project?**

Senior faculty mentored graduate students by discussing research results and providing guidance for research direction.

- **Which non-Ph.D. granting institutions are involved in this project?**

None.

Name of Project: Native American Outreach
Principal Investigator(s): Henry R. Lehrer, Ph.D.

• **Name of Other Sponsors matching funds, other related grant funding agencies and amount of match/grants:**

Nebraska EPSCoR	\$9,000
Aerospace States Association	\$29,000

• **Please provide a one-page description of your project's progress for the five-year EPSCoR period (1997-2001):**

This outreach initiative has had several distinct parts. Specifically the effort has focused on improving mathematics and science skills among the Native American students in the state's reservation schools and tribal colleges. The initiative began over 5 years ago and the primary focus at that time was infrastructure building. It was important to interface with Native American administrators as an initial effort before any other additional activities could be developed. Several successful initial meetings took place and it became quickly possible to contact any administrator and receive a response. This type of relationship building is a key reason for the success of the program.

The motivation of students is a second part of the program. Activities that involved 5th and 6th grade students were developed, particularly Aeronautics Day, a field trip, at the Sioux City Airport. Industry sponsors were the FAA, the 185 Fighter Wing of the Iowa Air Guard, the Sioux City Airport Authority, and JetSun Aviation. These same sponsors continue today and a total of close to 1,000 5th and 6th grade students have taken the field trip. In addition, library and technology enhancements at several schools and college were awarded as well as several scholarships.

Another part of the program has been the development of curriculum to include aeronautical units. The initial way that this was accomplished was by sending teachers to NASA sponsored workshops. A total of 14 teachers have attended one-week and two-week sessions, with the two-week sessions at NASA Ames. The teachers then have come back to their classrooms, developed implementation plans, and begun to use airplane and rockets as part of the regular science curriculum in upper elementary.

The signature activity that has moved the program from just a small bit of academic involvement in teaching science to a community-based activity has been Family Science Nights. Begun as a demonstration project at Santee Schools, the core idea is that students and their parents will attend evening school sessions that include joint activities based on science in which parents and children are joint participants. At this time 3 of the target schools have programs in place with the last of the schools to start with term. There has been active participation by students as well as parents and we are beginning to see many problems like school attendance, attention in class, and better grades overall take place. Although this is just an initial reading on the results, it is expected that this activity will continue to thrive.

We have worked with the two tribal colleges on a limited basis so far since we are attempting to develop the feeder program in mathematics and science in the lower grades first. However, these schools have not been ignored and a great deal of developmental activity is underway. This activity includes teacher fellowships, faculty development workshops, technology and library enhancements and focus group sessions. During the next few years, improvement of math and science facilities and equipment at these schools is a high priority.

- **What evaluation mechanisms were in place for this project? Please describe.**

We are using subjective work measures so far but have begun to do some accurate student tracking as far as attendance at Family Science Nights and improvement in science grades. While hard data is not yet a part of this effort, it is clear from the responses that have been gathered from parents, teachers, and administrators that the Native American Outreach of this effort is making a difference. It is expected that some descriptive as well as inferential statistical measure will be available.

- **Collaborative efforts took place with the following:**

- | | |
|---|--|
| <input type="checkbox"/> In Same Department
Name of department/ Type of Collaboration | <input checked="" type="checkbox"/> K-12 Institution
Name of institution(s)/ Type of Collaboration |
| <input checked="" type="checkbox"/> Other Departments in Same Institution
Name(s) of department/ Type of Collaboration
Physics Department - CAPOW Wagon | Winnebago Public Schools - Family Science Program
Santee Community Schools - Family Science Program
Walthill Public Schools - Family Science Program
Omaha Nation Schools - Family Science Program |
| <input type="checkbox"/> Other Institution of Higher Education
Name of institution(s)/ Type of Collaboration | <input type="checkbox"/> Teacher Resource Centers
Name of Teacher Resource Center/ Type of Collaboration |
| <input checked="" type="checkbox"/> Community College
Name of institution(s)/ Type of Collaboration
Little Priest Tribal College - Faculty Development and Curriculum Improvement
Nebraska Indian Community College - Faculty Development and Curriculum Improvement | <input checked="" type="checkbox"/> Non-Profit Organizations
Name of organization(s)/ Type of Collaboration
Nebraska EPSCoR – Tribal College
Aerospace States Association – Elementary Family Science |
| | <input type="checkbox"/> Organization(s) Representing Women, Underrepresented Minorities, or Persons with Disabilities
Name of organization(s)/ Type of Collaboration |

Industry/Business
Name of company or organization, location,
and type of collaboration

185 Fighter Wing Iowa Air Guard - Aeronautics Day
JetSun Aviation - Aeronautics Day
Sioux Gateway Airport - Aeronautics Day

• **Collaboration with NASA Installations: (If any of the following are checked, please provide name, department, phone number, and type of collaboration. If no collaboration is yet established, please state.)**

Ames Research Center, CA
Bonnie Samuelson: 650-604-6355 - Family Science
Tom Clausen: 650-604-5544 - Outreach and Family Science
Geoff Lee: 650-604-6406 - UAO
Liza Alderette: 650-604-3867: Outreach and Family Science
Doug O'Handley: 650-604-6746: NASA Academy
Joe Tanner: 650-604-6832: NASA Academy
Mike Landis: 650-604-6090: SATS Brief

Dryden Flight Research Center, CA
Dr. Kajal Gupta: NASA Academy
James Lucero: 661-276-2460: NASA Academy
Jo Ann Larson: 661-276-2472: Outreach
Katrina Emery: 661-276-5807; Outreach

Goddard Space Center, MD
Dave Rosage: NASA Academy

Jet Propulsion Lab, CA
Linda Rogers: 818-354-3274: Outreach

Johnson Space Center, TX

Kennedy Space Center, FL

Langley Research Center, VA

John Glenn Research Center at Lewis Field, OH

Marshall Space Flight Center, AL

Wallops

Stennis Space Center, MS

NASA Headquarters, DC
Julius Dasch: NASA Academy

• **Collaboration with NASA Enterprises (please describe):**

Code M. Human Exploration and the Development of Space

Code Y. Mission to Planet Earth

Code R. Aeronautics and Space Transportation Technology

Code S. Space Science

- **Collaborations with:**

- | | |
|---|---|
| <p><input type="checkbox"/> Other Space Grant Consortium program
Name of Space Grant and program/ Type of Collaboration</p> <p><input type="checkbox"/> Other Federal Government
Name of agency or program/ Type of Collaboration</p> <p><input type="checkbox"/> Other State Agencies
Name of agency or program/ Type of Collaboration</p> | <p>Name of agency or program/ Type of Collaboration
Aerospace States Association; Grant to develop Family Science during Fall 2001</p> |
| <p><input checked="" type="checkbox"/> Other Groups or Agencies</p> <p><input checked="" type="checkbox"/> Other EPSCoR Agencies:</p> <p style="padding-left: 40px;"><input checked="" type="checkbox"/> National Science Foundation
Through NE EPSCoR, an investigation of tribal colleges mathematics and science readiness</p> <p style="padding-left: 40px;"><input type="checkbox"/> Department of Defense</p> | <p><input checked="" type="checkbox"/> Other EPSCoR Programs
Name of EPSCoR Program/ Type of Collaboration
NE EPSCoR and the collaboration is a funded grant to investigate how to make tribal college student more competitive in math and science.</p> <p><input type="checkbox"/> Department of Energy</p> <p><input type="checkbox"/> National Institute of Health</p> <p><input type="checkbox"/> Environmental Protection Agency</p> <p><input type="checkbox"/> US Department of Agriculture</p> |

- **Please provide the names of the participants involved and indicate gender and ethnic background on the following table.**

- Names:
 1. Terri Greenleaf - Female - Caucasian
 2. Gary Hamm - Male - Caucasian
 3. Linda Whipple - Female - Native American
 4. Wanda Henke - Female - Caucasian
 5. Crystal Klein - Female - Caucasian
 6. Sandi Wachter - Female - Caucasian
 7. LeLand Henke - Male Caucasian
 8. Avonell Aprocaskas - Female - Caucasian

9. Shelly Richling - Female Caucasian

10. Shelly Avery- Female Caucasian

	Male	Male Under-represented (include disabled)	Female	Female Under-represented (include disabled)	Unknown Race/ Gender
Faculty	2	1	9	1	
Post-Doc					
Graduate Student	1		1		
Undergraduate Student					
Administrator	7	1	4	1	
Research Assist/Tech.					
Other					

If other, please specify:

- **Describe any recruitment and/or retention strategies for members of underrepresented groups (women, minorities, or persons w/disabilities) that ensure participation in this project:**

We have appointed and funded John Block at LPTC to work with aspiring students that show promise in mathematics and science.

We plan to send several students to the U of N. AZ Stargazer program this summer. The students will come from reservation schools. In addition, the Earth to Orbit and the Globe program from MSFC are planned for implementation the next two years.

- **Activities funded by this project:**

- | | |
|--|---|
| <input checked="" type="checkbox"/> Seed money for research | <input type="checkbox"/> Student Assistant |
| <input type="checkbox"/> Travel to present paper | <input type="checkbox"/> Computer Services |
| <input checked="" type="checkbox"/> Travel to attend conference/workshop | <input type="checkbox"/> Develop information resources for research opportunities |
| <input checked="" type="checkbox"/> Establish research collaboration | <input checked="" type="checkbox"/> Other (Specify) |
| <input type="checkbox"/> Visiting Scholar | Technology and library enhancement |
| <input type="checkbox"/> Hold conference or Workshop | at Little Priest Tribal College |
| <input checked="" type="checkbox"/> Proposal Preparation | |
| <input type="checkbox"/> Technical writing services | |

- **Publication Citations related to NASA EPSCoR funding. Please indicate Peer-reviewed/Refereed (if applicable), presentation (if applicable), include all of the citation.**

Presentation: Lehrer, H, & Zendejas, E. (October, 2001). Family Science Overview. Warm Springs, OR: NASA Western region Space Grant.

- **Grants & Financial Awards. Please include the following information in citation(s). Fellowships to faculty members at tribal colleges. Scholarships to students at the tribal colleges.**

- **How is this project contributing to the economic development of the state?**

We are developing a more educated consumer that is more aware of the benefits of aviation and advanced transportation systems.

- **Describe senior faculty mentoring junior faculty in this project?**

I am working with John Block, a mathematics instructor at Little Priest Tribal College. We are investigation applications of mathematics principals that relate to aeronautics that are applicable to elementary and secondary students.

I have done faculty development sessions at Little Priest and NICC on at least 5 occasions. The primary subjects were developing Powerpoint presentations and using an on-line teaching too, Blackboard. Com.

- **Which non-Ph.D. granting institutions are involved in this project?**

Nebraska Indian Community College
Little Priest Tribal College